THREE-DIMENSIONAL GESTURES

TECHNICAL FIELD

This disclosure generally relates to user interface.

BACKGROUND

A touchpad is an input device including a surface that detects touch-based inputs of users. A touch screen is an electronic visual display that detects the presence and location of user touch inputs. A proximity sensor is a sensor device that detect the presence of nearby objects without physical contact. A computing system (such as a mobile phone, a tablet computer, or a laptop computer) often incorporate those devices to facilitate user interactions with application programs running on the computing system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an example processing stack of a mobile device.

FIG. **2** illustrates an example mobile device.

FIG. **3** illustrates an example method for providing user inputs with three-dimensional gestures.

FIG. **4**A illustrates an example three-dimensional gesture.

FIG. **4**B illustrates an example user interface of a music player application.

FIG. **4**C-**4**F illustrate another example three-dimensional gesture.

FIG. **4**G illustrates an example user interface.

FIG. **4**H illustrates yet another example three-dimensional gesture.

FIG. **5** illustrates an example network environment of a social-networking system.

FIG. **6** illustrates an example social graph

FIG. **7** illustrates an example computer system.

DESCRIPTION OF EXAMPLE EMBODIMENTS

A touchpad is an input device including a surface that detects touch-based inputs of users. Similarly, a touch screen is an electronic visual display surface that detects the presence and location of user touch inputs. So-called dual touch or multi-touch displays or touchpads refer to devices that can identify the presence, location and movement of more than one touch input, such as two- or three-finger touches. A system incorporating one or more touch-based input devices may monitor one or more touch-sensitive surfaces for touch or near touch inputs from a user. When one or more such user inputs occur, the system may determine the distinct area(s) of contact and identify the nature of the touch or near touch input(s) via geometric features and geometric arrangements (e.g., location, movement), and determine if they correspond to various touch events or gestures (e.g., tap, drag, swipe, pinch).

Recognition of touch events by a system with one or more touch-based input devices—i.e., identifying one or more touch inputs by a user and determining corresponding touch event(s)—may be implemented by a combination of hardware, software, or firmware (or device drivers). FIG. **1** illustrates an example processing stack of a mobile device (e.g., a smart phone, a tablet computer). In the example of FIG. **1**, the mobile device may comprise hardware devices (**120**) such as Input-Output (I/O) devices (e.g., a touch screen, speakers, a light-emitting diode or LED indicator, a camera, etc.), communication interface devices (e.g., a cellular interface, a Wi-Fi interface), sensors (e.g., a Global Positioning System or GPS sensor, a proximity sensor, an accelerometer, etc.), and other hardware devices. One or more device drivers in driver layer **102** hosted by one or more processors **110** of the mobile device can communicate and control the hardware devices. One or more processors **110** can execute various software programs, for example, operating system **103** running one or more application programs (e.g., web browser, address book, etc.) in applications **105** and managing one or more hardware devices via the one or more device drivers in driver layer **102**. Libraries **104** can include one or more libraries used by one or more application programs in applications **105**. For example, the mobile device may comprise one or more device drivers communicating with one or more touch-based input devices and detecting touch inputs. The system may comprise a touch gesture library containing touch event modules or computer program code for interpreting touch inputs detected by the device drivers to touch events or gestures. A program running on the mobile device can detect and process touch events by subscribing as listeners to touch event modules in the touch gesture library.

In addition to detecting touch or near-touch inputs using one or more touch input devices (e.g., touchpad, touch screen), a system may also detect a location and movement of an object at a distance away from the system's surface by incorporating one or more sensor or input devices. For example, a proximity sensor may detect the presence of nearby objects without physical contact. For example, a camera capturing a substantially real-time video may determine a distance and angle of an object (relative to the camera) in the video based on a focus distance and angle associated with the object. This disclosure contemplates any suitable sensors for detecting a location and movement of an object touching or at a distance away from the system's surface. A system incorporating one or more touch input devices, proximity sensors, or cameras may determine a location and movement of an object touching or at a distance away from the system's surface based on measurements of the object by the touch input devices, proximity sensors, or cameras (e.g., by using triangulation techniques). By continuously monitoring the touch input devices, proximity sensors, or cameras, the system may determine a three-dimensional trajectory of a moving object based on measurements of the object by the touch input devices, proximity sensors, or cameras. A user may provide inputs to the system by performing three-dimensional gestures. For example, a three-dimensional gesture may be the user's fingertip touching a front surface of the system and then pulling away from the front surface. When detecting such a three-dimensional user input, the system may determine a three-dimensional trajectory (e.g., of the user's fingertip), and determine if the three-dimensional trajectory corresponds to one or more three-dimensional gestures. The system may comprise a three-dimensional gesture library containing three-dimensional input modules or computer program code for calculating and interpreting three-dimensional input trajectories (detected by the touch input devices, proximity sensors, or cameras) to three-dimensional gestures. A program running on the system can detect and process three-dimensional gestures by subscribing as listeners to the three-dimensional input modules in the three-dimensional gesture library.

FIG. **2** illustrates an example mobile device. In the example of FIG. **2**, mobile device **200** may comprise a housing with a touch display **201** disposed on a front side of the housing. Touch display **201** may be a single-touch,